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ABSTRACT

This study followed the development of visual preferences in a single infant from birth to 10 weeks of age. The stimuli used were 5 x 10 item arrays of squares or lines in which a 3 x 3 target matrix of the other figure type (line or square) was embedded. The direction of first fixation and the total time spent looking at each side were determined by direct observation of the infant's eyes. Half of the stimulus cards contained black figures on a white background, half white figures on a black background. A brightness preference would be indicated by fixation on lines on white cards, and on squares on black cards. Preference for high contour density would lead to fixation on the squares on both types of cards. Control cards on which no target matrix appeared were used to determine whether response biases were present. The results indicate an abrupt shift from brightness to contour preference at 5 to 6 weeks of age, consistent with other evidence for a major reorganization of behavior at this time. Furthermore, these changes in visual behavior were found to coincide with changes in the distribution of time spent in different behavioral states. Figures present stimulus materials and findings. (Author/BH)

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Visual Preference in the First Ten Weeks of Life

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Visual Preference in the First Ten Weeks of Life

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Abstract

The determinants of visual preference in infants under two months of age have not been established. This study followed the development of visual preferences in a single infant from birth to 10 wk of age. The stimuli used were 5 x 10 item arrays of squares or lines in which a 3 x 3 target matrix of the other figure type (line or square) was embedded, 10° visual angle (va) to the left or right of center. Each figure in the array subtended 5° va in length. The direction of first fixation and the total time spent looking at each side were determined by direct observation of the infant's eyes. Half of the stimulus cards contained black figures on a white background, half white figures on a black background. A brightness preference would be indicated by fixation of lines on white cards, but of squares on black cards. Preference for high contour density would lead to fixation of the squares on both types of card. Control cards on which no target matrix appeared were used to determine whether response biases were present. The results indicate an abrupt shift from brightness to contour preference at 5-6 wk of age, consistent with other evidence for a major reorganization of behavior at this time. Furthermore, these changes in visual behavior were found to coincide with changes in the distribution of time spent in different behavioral states.

Visual Preference in the First Ten Weeks of Life

The fact that infants exhibit a preference for looking at certain types of stimuli over others has been used not only to test visual acuity in infancy, but also to determine the stimulus dimensions which are most important in controlling visual attention. This experiment was designed to determine whether changes in the stimulus dimensions which seem to control visual attention occur over the early weeks of infancy. It was part of a short-term longitudinal study of one infant, my daughter, from her birth until she was ten weeks old.

Numerous studies, notably those reviewed by Karmel and Maisel (1975), have attested to the importance of contour density, i.e., the amount of contour in a fixed area, in determining visual preference in infants older than 6-8 weeks. However, prior to that age, preference seems to be an inverse function of contour density, and those investigators, as well as others, have suggested that the younger infant may be attracted to local areas of greater brightness in stimuli with low contour density. On the basis of these findings, one might conclude that different neural mechanisms control visual behavior before and after about six weeks of age. The first mechanism is thought to direct the infant's attention to higher luminance stimuli, while the second causes the infant to concentrate on areas of high contour density. The present study compared visual preference for brightness and contour density over a ten week period in order to test this hypothesis. The results indicate that, in fact, a shift in visual preference control from brightness to contour does take place during that time. These changes in visual preference were found to occur in a relatively abrupt manner.

The stimuli used to test visual preference consisted of 5 x 10 arrays of forms, similar to those employed by Salapatek (1975) to test for form discrimination. The two forms employed were a horizontal line and a square. Each line subtended 5° visual angle in length and 30' visual angle in width. On control cards, the entire array consisted of one of the forms. On target cards, a 3 x 3 matrix of the other figure was embedded in the array 10° visual angle to one side (Figure 1). Cards with a matrix of squares in an array of lines, and cards with a matrix of lines in an array of squares were constructed.

We can ask, then whether the subject would look at lines or at squares on target trials. However, when black figures are presented on a white ground, the side of the target card containing lines would not only contain fewer contours, but would be brighter as well. In order to separate the effects of brightness and contour density, a second set of cards containing white figures on a black ground was also constructed. Thus if the subject had a brightness preference, she would look at the line side of the card on white backgrounds, but at squares on black backgrounds. If, on the other hand, she preferred higher contour density, she would look at the squares, regardless of the direction of contrast. The embedded target matrix was presented equally often on the right and the left sides of the card. Control cards were included so that correction for left-right response bias would be made.

The baby was tested once each week for seven weeks and again during the tenth week. Sessions were run on the test day whenever the baby was judged to be quiet and alert. If the baby started to fuss or cry during

a session, or if she turned away from the stimulus before the end of a trial on three consecutive trials, the session was interrupted and continued later in the day when the baby's mood had improved. In the early weeks as many as four such interruptions occurred. However, after 4 weeks a complete set of data could usually be collected in only 1 or 2 sittings.

During test sessions, the subject was placed in an infant seat with pads at the sides of her head to keep it toward midline. The area was illuminated from above and stimuli were presented 12" from the infant's face. The stimulus card was held in place against a larger board with a peephole in the center, just above the stimulus card. The entire board was lowered between trials, so that the experimenter would have easy to the baby in case of a state change. A clock just above the infant's head was used to time a trial, and the observer used a stopwatch to record the amount of time the infant spent looking at the left side of the stimulus.

On each trial, a red ring was dangled before the baby's eyes to direct her gaze at the center of the field. When the baby was looking at the center of the field, the stimulus was raised in front of her and eye movements observed through the peephole. Each trial lasted 30 sec. If the infant looked away from the stimulus before the trial was over, the trial was discarded and a new one run to replace it. Thirty-two trials were collected on each of the eight test days, with all combinations of card type (control or target), direction of contrast (black on white or white on black) and type of background form (square or line) represented.

Both the direction of first fixation and total time spent looking at one side were recorded, allowing for the possibility that the stimulus

characteristics that first attract the infant's attention are different from those that hold his attention for prolonged periods. These two processes--attention getting and attention holding--might also develop in different ways as the infant matures.

In Figure 2 are shown the proportions of trials on which the infant turned toward the brighter side of the stimulus and the proportion of trials on which she turned toward the higher contour density side for the eight sessions. (Note that these proportions do not sum to 1, since the sets of "bright" and "contour dense" stimuli overlap.) Preference is indicated when this proportion is greater than .5. During the first two weeks, only a weak preference for the brighter side is exhibited. However, by three weeks, a much stronger brightness side preference is found. After 4 weeks, on the other hand, the brightness preference falls off and by 5 weeks a preference for contour density is clearly present, and remains strong through the tenth week. The crossover between attention to brightness and attention to contour is rather abrupt, then, being completed over a 2 wk period.

In terms of the proportion of time spent looking at each target type, a similar pattern of results emerged (Figure 3): a rather dramatic change from looking at the bright side to looking at the contour dense side occurs at week 5. Note, however, that the tendency to spend time looking at the bright side peaks at week 1 and declines thereafter--unlike first fixation on the bright side, which peaked at week 3. The latter finding may indicate a difference between attention getting and attention holding mechanisms in the early weeks.

Further evidence concerning this distinction is found when the proportions for trials on which the "target" was the array and for trials on which the "target" was the embedded matrix are considered separately. That is, when the baby exhibited a contour preference, was it stronger when the squares made up the background array or a 3 x 3 matrix of squares was presented? When the proportion of time spent looking at a side is considered, the answer seems to be yes--the infant showed stronger preferential looking when the entire side of the card was more contour dense (or brighter in the early weeks) than when only the 3 x 3 matrix of squares was present. This difference is on the order of 5-10%. However, if preference is measured as the direction of first fixation, no such difference appears. Thus the moderately bright or contour dense side of the card attracts the infant's attention as often as a higher level, but it doesn't seem to hold his attention as long.

These data, then, support the contention that the mechanism controlling visual attention changes dramatically at about 5-6 weeks of age. It also indicates important differences between attention getting and attention holding processes during the early weeks. Interestingly, the change in visual preference coincided with a number of other behavioral shifts. For example, it was in the fifth week when this subject showed a decline in the amount of active sleep, an increase in alert time and a decrease in crying and fussing. Thus the age under consideration here may be a time of a major reorganization which affects many behaviors, including visual ones.

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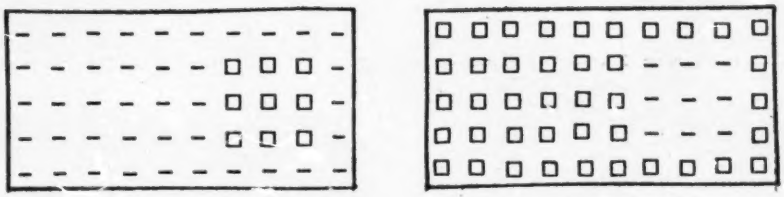

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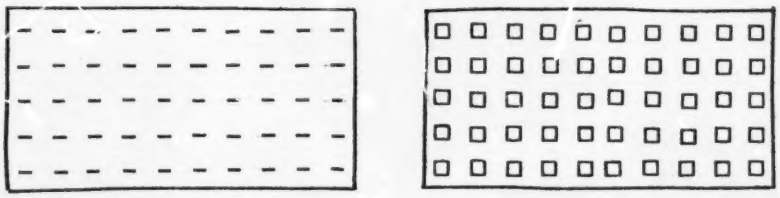
TARGET CARDS



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CONTROL CARDS

FIG. 1 Stimulus cards

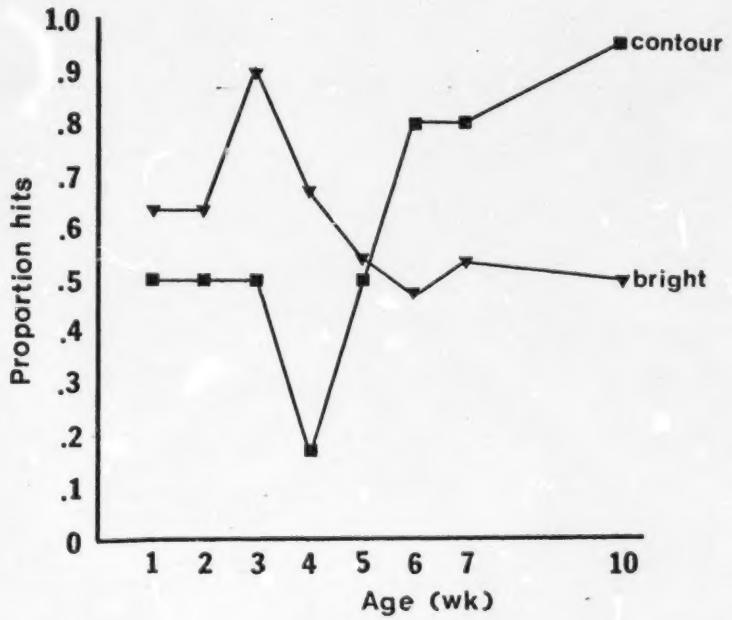

FIG. 2 Proportion of first fixations on brighter and on higher contour density targets as a function of age

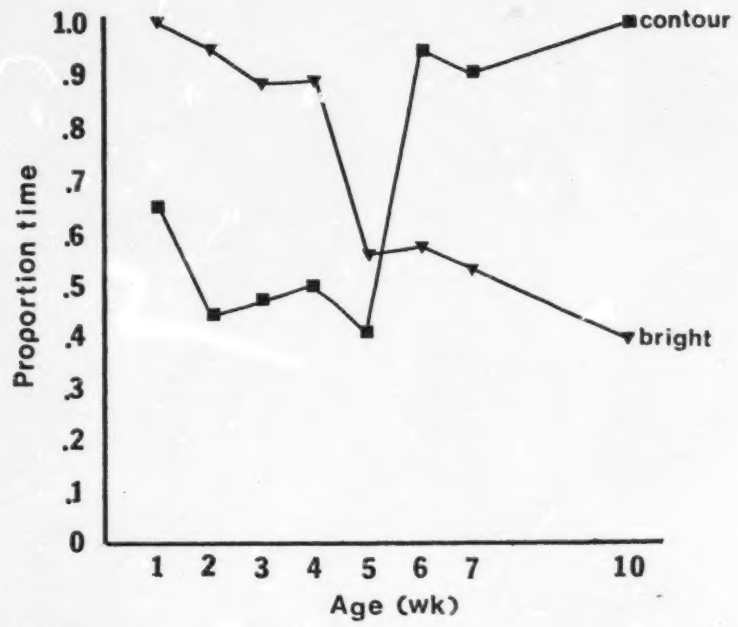

FIG. 3 Proportion of time spent looking at brighter and at higher contour density targets as a function of age